MODIS Science Team Semi-Annual Report

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with contributions from E. Vermote, J. Morisette, J. Descloitres

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a) Task Objectives

This reporting period covers the period of preliminary evaluation of AQUA products. The MODIS Terra products are continue to be validated and are being disseminated by the EDC DAAC. This period includes the Rapid Response System growth and development in collaboration with various users, through national collaborations and internationally through GOFC/GOLD, a project of the Global Terrestrial Observing System (GTOS). Emphasis has been on continuing evaluation of the products, a preliminary evaluation of the Aqua fire products, determining product accuracy and outreach to users, answering questions and providing information on the product. The period also included a user outreach workshop on the MODIS Fire Products. This was held in conjunction with the GOFC/GOLD annual workshop at the University of Maryland. Considerable attention has been given to coordinating the land product validation activities and outreach to the user community.

We continued to build the collaborations required to conduct the work of developing community consensus algorithms on Fire, Surface Reflectance which is an input to the MODIS Vegetation Indices. The project developed a number of collaborative activities that are intended to expand the scope of the team members' activities and involve a larger community in MODIS research and product validation.

Chris Justice participated in the Science Team Meetings, the Discipline Leaders meetings and whenever possible, the Land Science Data Development Team Meetings and the Technical Team (TT) Meetings. In addition, the goals of the MODIS project, the status of the instrument and the results of this MODIS supported research were presented at scientific meetings. Results of the studies undertaken as part of the project are in the process of being written up and submitted for publication. This reporting period covered the completion and publishing of the MODIS Land Special Edition of Remote Sensing of the Environment (RSE) on Early Product Validation.

In agreement with the MODIS Project Scientist, resources from this project continue to support the MODIS Surface Reflectance product and the Fire Rapid Response System. This includes providing shared support for personnel and computer resources with Dr. E. Vermote, Dr Jacques Descloitres and the Land Science Data Team at GSFC. During this reporting period, refinements to the current fire algorithm were investigated by Dr. Vermote.

b) Tasks Accomplished

1) Code Development, Delivery and Product Quality Assessment (Giglio)

Giglio attended nine MODIS Land SDDT meetings concerning code status, testing plans and development of quality assurance (QA) tools for the MODIS surface reflectance and fire products.

Giglio completed version 4.3.1 of the MODIS L2 fire code. This version includes a completely new detection algorithm that offers many fewer false alarms in areas in which the original algorithm had persistent problems (Eritrea, Pakistan, and India for example), and a greatly improved ability to detect smaller fires. Incorporated additional improvements to reduce false alarms that have been appearing due to inaccuracies in the MODIS land/sea mask. Giglio delivered the code to MODIS Land Integration and Test Team on 20 September 2002. A complete description of the algorithm was reported in the paper "An Enhanced Contextual Fire Detection Algorithm for MODIS" by L. Giglio, J. Descloitres, C. O. Justice, and Y. J. Kaufman, and was submitted to the journal *Remote Sensing of Environment*.

Giglio resumed work on the MODIS fire Climate Modeling Grid code following start of Collection 4 reprocessing on 20 December. This product will be generated at 0.25° spatial resolution on a daily and monthly basis.

Giglio prepared presentations on the status of the MODIS active fire algorithm, and ways of obtaining MODIS data, at the MODIS Fire Outreach Meeting held on the evening of 17 July. Giglio also attended GOFC/GOLD Fire and IGBP-IGAC/BIBEX Biomass Burning Emissions Workshop held 17-19 July at UMD. Giglio also attended the MODIS Science Team Meeting held on 22-24 July.

Giglio prepared and delivered a MODIS fire product status presentation for the MODIS Land Collection Version 4 (C4) Reprocessing Review meeting held on 12/17.

2) NPP VIIRS (Giglio/Justice)

The MODIS fire group continued to support the NPP Fire algorithm activities. Giglio continued to evaluate the plans for VIIRS fire characterization and suggest alternative approaches to improving the instrument and algorithms for fire monitoring.

3) MODIS Active Fire Product Validation and Analysis (Csiszar) with contributions from Giglio, Justice and Dr. Jeff Morisette (NASA/GSFC).

The collaborative effort to validate the MODIS active fire product with coincident ASTER observations has continued. Csiszar processed coincident ASTER level-1b and MODIS data (MOD021km level-1b, MOD03 geometry and MOD14 fire product) over South America, Northern Eurasia and Mexico for the evaluation of the MODIS active fire product. He created imagery of ASTER fires and overlain MODIS fire detection results, and intermediate product for quantitative statistical analysis. Morisette determined the MODIS detection probabilities based on summary statistics characterizing sub-MODIS-pixel scale fire properties. Csiszar worked on an ASTER cloud masking test and on the calibration of ASTER radiances to improve the validation methodology and the interpretation of the results. He presented results of the analyses in meetings in Siberia and Bolivia and

prepared a poster for the AGU Fall meeting, presented by Morisette. The group also worked on the revision of the paper "Validation of the MODIS Active fire product over Southern Africa with ASTER data" by J. Morisette, L. Giglio, I. Csiszar and C. Justice, submitted to Remote Sensing of Environment.

4) Global Analysis of active fire distributions from MODIS (Csiszar) with contribution from Giglio

MODIS fire locations for the Rapid Response system were processed for the April 2001-Decmber 2002 period. In the analysis corrections for the change of sampling frequency with latitude and for missing data were introduced. The frequency of fire occurrence was determined for each month, and for each land cover type using the University of Maryland 1-km AVHRR Land Cover data set.

5) MODIS experimental burned area product validation (Csiszar) with contributions from Giglio, and Roy (NASA/GSFC).

Four MODIS 10 degree tiles were selected for the validation of MODIS burned area maps in Siberia and the Russian Far East. A number of Landsat-7/ETM+ scenes were acquired. The scenes, along with several ASTER scenes used for the active fire validation, were imported into a GIS framework and burn scar polygons were created. The collection and archival of intermediate products from the MODAPS collection 4 processing for Roy's product was set up for the four selected MODIS tiles. Input files for Giglio's experimental algorithm were also collected from DAAC over the same tiles. An initial burned area map for a tile for the 2002 fire season was created by Giglio and imported into the GIS framework. Initial analysis has shown a good overall performance as well as some problem areas.

Csiszar has continued working with Russian partners at various central and regional Institutes of the Russian Academy of Science on the use Rapid Response products in support of fire management over Russia. He and Justice participated in an initial kick-off GOFC/GOLD regional fire meeting in Krasnoyarsk in August. Csiszar followed up on this activity and reported on it at the US-Russian Earth Science Joint Working Group meeting in Moscow in October. This activity has also become an integral part of the

emerging Northern Eurasian Earth Science Partnership Initiative led by NASA and the Russian Academy of Sciences.

6) Transitioning MODIS Land Rapid Response System to Operational Status in NOAA

In September Justice gave a presentation on MLRRS at the NOAA/NESDIS SPSRB meeting. The NOAA partners also sought the endorsement of the NOAA upper management, particularly that of Helen Wood of NOAA/OSDPD. Csiszar worked on establishing a formal arrangement between NOAA, the Earth Science Interdisciplinary Center and the Department of Geography.

7) SAFARI 2000 campaign and MODIS regional emissions (Korontzi) with contributions from D. Roy (UMd)

Stefania Korontzi continued her research on dynamic modeling of fire emissions from southern African savannas using the experimental MODIS burned area product for southern Africa (provided by D. Roy UMd). She presented results from the intercomparison of the GBA-2000 European Space Agency and the MODIS burned area products within the context of emissions modeling at the SAFARI 2000 synthesis meeting and at the annual LCLUC Science Team meeting. She has completed her analysis on seasonal emission factors from savanna fires. Furthermore, she has developed an integrative database of emissions factors in southern African savanna fires, using results from the SAFARI-92, SAFARI 2000 and her own work. She has submitted a manuscript that describes the results. She is currently preparing a manuscript that will present fire emissions during the SAFARI 2000 dry field campaign.

8) MODIS Fire Science and Applications Outreach

Chris Justice worked with Emilio Chuvieco on MODIS Fire outreach in South America. Ivan Csiszar on request from NASA attended the SELPER Workshop in Bolivia. Justice had further discussions with the Canadian Forest Service on MODIS fire detection capabilities in Canada. Justice presented the MODIS Fire capabilities at the GOFC/GOLD Workshop in Krasnoyarsk. Justice and Csiszar met with Andre Kushlin (World Bank) to discuss extension of MODIS fire sensing capabilities to Siberia.

Csiszar also worked with regional partners in Russia on the use and validation of the MODIS active fire products in the region, including in-situ observations from the Russian Air-based Fire Protection Service (Avialesookhrana).

Justice attended the SAFARI 2000 Synthesis Workshop at UVA and presented MODIS Fire Results. Justice and Giglio presented MODIS fire monitoring capabilities to a delegation from the Mexican and US Forest Services.

Material on MODIS was added to the NASA Fire Community Web site in NASA Ames. Justice met with HQ management to discuss MODIS fire applications. Presentations were sent to Ron Birk, Steve Ambrose, Ed Sheffner.

During this reporting period the MODIS Rapid Response System was further developed as a contribution to the international GOFC/GOLD-Fire program. John Owens worked closely with Australian counterparts to provide software and technical backstopping on the UMD Firemaps for the CSIRO Sentinal system, which is currently up and running. Support was given to the CONABIO group in Mexico associated with MODIS fire product and direct broadcast. The UMD fire counts data base was updated and the ftp site streamlined. Giglio assisted M. Schmidt of the Comision nacional para el conocimineto y uso de la biodiversidad (CONABIO) diagnose various problems his group was having running the Rapid Response codes on their MODIS Direct Broadcast system. Giglio also assisted A. Marks of the CSIRO Land and Water Environmental Remote Sensing Group in Australia to diagnose a few fire-code-related problems his group was experiencing.

9) Papers In Press

A review of current space-based fire monitoring in Australia and the GOFC/GOLD program for international coordination. C. O. Justice, R. Smith, M. Gill, I. Csiszar - **International Journal of Wildland Fire** – in press

Korontzi S.A., Justice C.O. , Scholes R.J. The influence of timing and spatial extent of vegetation fires in southern Africa on atmospheric emissions. **Ambio**

Kaufman Y.J., Ichoku C., Giglio L., Korontzi S., Chu D.A., Hao W.M., Li R.R. and Justice C.O., Fires and smoke observed from the Earth Observing System MODIS instrument – products, validation, and operational use. **International Journal of Remote Sensing.**

Giglio L., and Justice C.O. Effect of wavelength selection on characteristics of fire size and temperature. **International Journal of Remote Sensing**.

S. Korontzi, D.E. Ward, R. A. Susott, R.J. Yokelson, C.O. Justice, P.V. Hobbs, E. Smithwick and W.M. Hao (2003). Seasonal variation and ecosystem dependence of emission factors for selected trace gases and PM2.5 for southern African savanna fires. **Journal of Geophysical Research**, in review.

S. Korontzi, C. O.Justice and R. Scholes (2003). The influence of timing and spatial extent of vegetation fires in southern Africa on atmospheric emissions, **Journal of Arid Environments**, in press.

S. Alleaume, C. Hély, , J. Le Roux, S. Korontzi, D. Roy, R.J. Swap, H.H. Shugart, and C.O. Justice (2003). Using MODIS to evaluate heterogeneity of biomass burning and emissions in southern African savannas: The Etosha National Park Case Study, **International Journal of Remote Sensing**, in press.

C. Hély, P. Dowty, S. Alleaume, K. Caylor, S. Korontzi, R.J. Swap, H.H. Shugart, and C.O. Justice (2003). Regional fuel load for two climatically contrasting years in southern Africa, **Journal of Geophysical Research**, in press.

Giglio, L., Descloitres, J., Justice, C. O., and Kaufman, Y. J., An Enhanced Contextual Fire Detection Algorithm for MODIS, **International Journal of Remote Sensing** submitted.

Schroeder, W., J.A. Raposo Pereira, J. Morisette, I. Csiszar, P. Riggan and J.W. Hoffman, 2002: The "FiremapperTM" Airborne Sensor and Flight Plans to Support Validation of MODIS Fire Products over Brazil. **Earth Observer**, 14, Nov./Dec. 2002, 38-41, 45.

10) Papers and Posters Presented

Southern Africa Fire Emissions using MODIS (S. Korontzi – **NASA LCLUC Science Team Meeting**, Maryland

Fire detection with MODIS. **SCOPE Workshop: Forest Conservation and Management in an Information Age**, Woods Hole, MA.

Validation of MODIS active fire products in South America with coincident ASTER data. **X Symposium of the Latin American Remote Sensing Society**, Cochabamba, Bolivia.

Fire Mapping and Monitoring within the GOFC/GOLD Program: Organization and Implementation. **X Symposium of the Latin American Remote Sensing Society**, Cochabamba, Bolivia.

Fire validation activities by the CEOS WGCV Land Product Validation subgroup. **X Symposium of the Latin American Remote Sensing Society**, Cochabamba, Bolivia.

Development of an integrated system of ground-, air- and space-based observations of biomass burning in Northern Eurasia. **XII meeting of the US-Russia Earth Sciences Joint Working Group**, Moscow, Russia.

Validation of MODIS active fire products in Siberia with coincident ASTER data. **XI International Conference of IBFRA and Regional GOFC/GOLD Workshop**, Krasnoyarsk, Russia.

Validation of the MODIS active fire product by coincident ASTER observations in Southern Africa. **Joint GOFC/GOLD and IGBP-IGA/BIBEX Fire Emissions Workshop,** College Park, MD.

11) New Staff

Mark Sullivan – hired as a system engineer to support the development of the MODIS burned area product and the rapid response system

Tatiana Loboda – Graduate Research Assistant

John Owens - Resigned for personal reasons